Guidelines for Using the Microcomputer in the Elementary School

Curriculum Development
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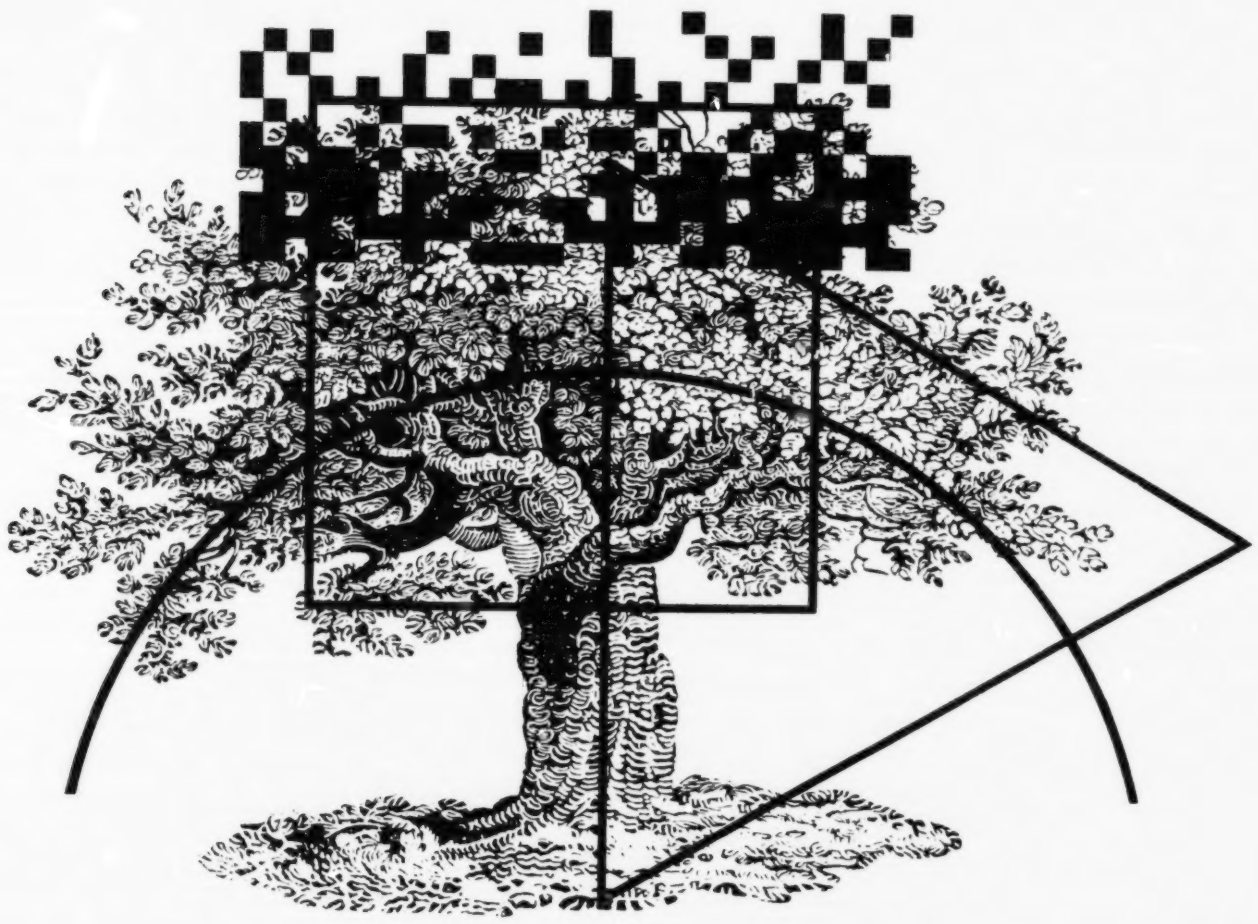

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S e c t i o n 1

Preface and Background

These guidelines represent an examination of the role of microcomputers within the elementary school curriculum. They are the result of much discussion and reflection by the members of the elementary computer task force, and by other Nova Scotia teachers who have shared their teaching experiences with the committee. The Department of Education expresses its thanks to the comittee members and to those teachers who took the time to document and submit the scenarios presented in Section 3.

The Nova Scotia Department of Education encourages a considered approach to the use of the microcomputer in support of learning. These guidelines address appropriate applications of microcomputer technologies in the elementary school program.

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The Aims of Public School Education

The general aim of public education in Nova Scotia, as stated in the *Public School Program*, is to provide a school environment that will enable students to develop the ability to think clearly, to communicate effectively, to make sound judgments, and to discriminate among values. The major goals in teaching children and young people are:

a. to develop skills that can help them achieve their full potential mentally, physically, and socially;
b. to help them acquire knowledge and understanding needed for a full, rich life and for making a useful contribution to society;
c. to encourage positive attitudes to school and learning.

The Objectives to be Achieved Through the Curriculum

The expected learning outcomes of the various components of the curriculum, in summary, are:

- the development of communication skills through meaningful and relevant language use;
- the discovery of order and pattern; the relationships of number, measurement, and space and shape; and the development of the ability to apply this knowledge to the solution of problems;
- the development of curiosity and critical thinking through the exploration of the natural world;
- the development of an understanding of the global interdependence of all peoples;
- the development of a physically active lifestyle;
- the development of aesthetic expression, response, and discrimination.

The following basic assumptions about the process of learning are fundamental to these guidelines:

- the learner must be actively involved in the learning process;
- learning, by nature, is a social activity, one in which the child needs to interact with others; and
- language plays an essential role in learning.

The Role of Technology in Realizing Educational Goals

Throughout history, teachers have used technologies when it seemed appropriate. Today many new technologies are emerging. As teachers gain experience with new technologies, they are using a variety of media to implement alternative learning and teaching strategies in classrooms. The range of possible learning resources is wide: print, film and video, concrete materials (real or model), audio materials, visual displays, and interactive media. No single medium is best to use in all situations with all learners by all teachers.

The teacher's use of technology has a significant effect in promoting learning. Many learning experiences depend on manipulation of the concrete, but not all concepts or experiences can be presented through manipulation of the "real thing". Technology provides teachers with opportunities to present realistic substitutes that can be used to extend or replace concrete experiences.

It should be recognized that while technology is being used to deliver instruction, the learner is also acquiring skills in dealing with technology. It is not necessary to teach about technology in isolation if the learner has the opportunity to use technology as part of the achievement of other educational goals.

In a discussion of computer use in elementary school programs, it is important to realize that the focus of instruction and learning is on the child, not on the machine. The microcomputer must be seen as a means to an end. The decision to involve a child in a specific computer experience should be based on the judgment that it is an appropriate learning experience for that child.

It is recommended that the computer be viewed as a tool for learning."

These guidelines will not present a scope and sequence of specific computer skills and concepts that should be taught in the elementary school program. A new add-on to the present curriculum is not suggested. Rather, this guide will highlight areas of the curriculum in which it seems appropriate to consider using this new technology. It is recommended that the computer be viewed as a tool for learning.

The Changing Computer Environment

This guide provides information available at the time of writing about the use of microcomputers in elementary education. While pedagogy and educational principles do not change rapidly, the technology surrounding the microcomputer is dynamic. The amount of experience in using the microcomputer in education is growing and will continue to develop over time. The technology is changing constantly. The quality of educational software continues to improve.

Decisions regarding the use of the microcomputer must not be cast in stone. Rather, as knowledge of computer applications and as experiences of this technology in the curriculum expand, new creative opportunities to improve instruction and learning through the use of the microcomputer will become evident. Teachers and administrators in Nova Scotia recognize that change will continue.

S e c t i o n 2

The Computer as a Tool for Learning

What are the most appropriate areas of the elementary curriculum within which to include a computer experience? This question has no single answer. It is dependent on many factors: the characteristics of the learners, the subject matter at hand, the training and experience of the teacher, the availability of educational software, and the availability and configuration of computer hardware. It should not be assumed that the microcomputer can be used effectively in all parts of the program.

The Computer as a Tool for Written Expression

The Computer as:
- *a Tool for Written Expression*
- *a Tool for Illustrating*
- *a Tool for Developing Thinking.*

The 1986 guide *Language Arts in the Elementary School* states that: "Writing is a process through which the writer constantly tries out ideas, rethinks, and revises." Depending on the type of writing and the intended audience, the writer may move back and forth through a cycle of pre-writing activities; to a first draft; to conferencing and peer editing in the editing phase; to rewriting; and finally to a publishing phase.

The word processor is an appropriate electronic tool to use in the teaching and practice of writing. A word processor is a computer program which turns the microcomputer into an electronic typing machine which has memory. Text is created on the computer screen and is stored temporarily in the memory of the computer. With text in an electronic form it is very easy to correct typing mistakes, misspellings, and grammatical errors. It is also simple to move parts of the text from one place to another, or to remove a part of a passage completely.

The word processor provides a great benefit during the rewriting, editing, and publishing phases of the writing process. There is no other medium for writing that provides the capabilities and flexibility of the word processor for rethinking one's thoughts and expression. Anything can be changed. It is usual for a writer to have the computer print a document on paper and then to use this copy for proofreading. The word processor is then used again to edit, add to, delete from, and rearrange the writing. With most word processors, the writer can try different print-outs with various margin settings, indentations, centring, and print sizes until he/she is satisfied with the final copy.

The word processor may also be useful for some children earlier in the writing cycle, during the writing phase. The child who is skilled in the use of the word processor and familiar with the computer keyboard may create with wild abandon. The child who is just beginning to use the computer for writing may experience some frustration, particularly if the flow of ideas comes more quickly than the fingers respond. This, of course, is not exclusive to writing on a keyboard but may be true of handwriting as well. Some students become so fascinated with the ease of correcting text in a word processor that they correct everything as they go and, therefore, may get distracted from their thoughts.

An observation that has been made of students using word processors is that, when given an opportunity and facility to self-correct, they will. Students have displayed very positive attitudes

towards the editing phase of the writing process in comparison to pencil and paper writing where a simple change may involve laborious rewriting of the entire passage, often with additional mistakes.

Teachers who have used the word processor in teaching writing have made the following observations:

- children who write using the word processor seem to write more;
- these children tend to self-correct more often;
- children seemed to be more accepting of constructive criticism knowing that anything can be easily corrected or changed; and
- children display pride and pleasure in their finished, published work.

A remarkable phenomenon may be observed among children who frequently use the computer for writing. Without any formal instruction in the use of the keyboard, their speed and accuracy increases. However, the upper limits for this natural growth are often reduced by the awkward, inefficient method adopted for striking the keys. The most typical examples are the "hunt and peck" and "cross handed" approach. It seems that keyboarding skill is important, but even with minimal typing skill, word processing can be an enhancement of the writing process.

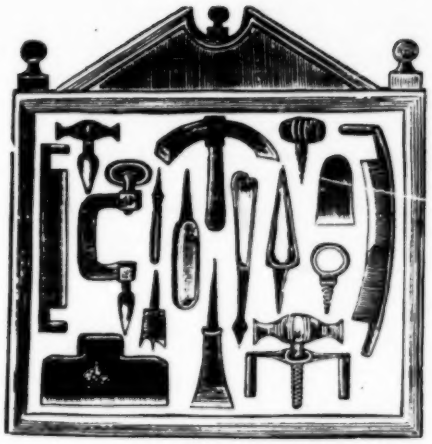
The amount of time available for hands-on writing activity is an important consideration in the decision to include a word processing experience as part of the writing program in the elementary school years. If writing is being encouraged as an everyday activity, and a word processing program is being promoted as a tool of choice for writing, schools must be prepared to make computers available for that purpose. Both the placement of computers and the number of machines available need to be considered.

The Computer as a Tool for Illustrating

Children express themselves in a variety of ways with a variety of media: crayon coloring, free-hand pencil drawing, finger painting, and others. With the development of "publishing software", graphics programs and various devices - graphics pads, mice, joysticks - children can also use the electronic media for creative expression.

"Publishing software" includes programs like *The Print Shop* and *The Newsroom* that allow a child to mix text and graphics on a page. *The Newsroom* allows the student to produce a page of print and illustrations in a newspaper format. *The Print Shop* makes it possible to produce greeting cards, note paper, posters, and other printed products. Children of all writing abilities have demonstrated an interest in using these programs to express themselves. Often a reluctant writer will give a great deal of thought to the message to be placed on a greeting card being designed. The array of graphic designs available in these programs may encourage some children to include more detail and give more thought to their handiwork.

Graphics devices, when connected to a microcomputer, usually provide a drawing screen and a set of drawing tools. Some examples are *The Koala Pad* and *Mousepaint*. With these programs, the child is



able to move a pointer about and see the results on the computer screen. Different devices provide different drawing tools, but most will include shapes, colors, shadings, and text. Most programs will allow a child to save a picture on a disk for later work, and/or print a picture on a printer.

The Computer as a Tool for Developing Thinking

One of the ways in which teachers address the educational aim of helping children "to develop the ability to think clearly" is through problem solving experiences. Generally, teachers attempt to design learning situations for children which lead them to use the concepts, processes, information, and strategies that they have learned throughout the curriculum.

Some of the best educational software being written encourages the development of thinking skills using problem solving situations. Usually, these programs present children with a set of objects to use to focus their thinking. The objects have attributes and properties which establish the scope of the problem. The student is given a problem to solve using the objects and a set of rules. All intermediary steps and the ultimate solution of the problem are under the control of the learner.

A classic example of problem-solving software is *The Factory*. In this program, the child has three "machines" from which to pick to place on an "assembly line". Each machine will act on a white square as it moves through the assembly line. When the square emerges, the child can see the results of this particular combination of machines. In one part of the program, the child is shown a finished product and is challenged to establish an assembly line of machines which would recreate the product.

With *The Factory*, a child is given a learning situation through which to explore the effect of sequence and order, to visualize spatial relationships, and to use various problem-solving strategies. The microcomputer is simply the vehicle for delivering this experience. Such software should be used to supplement and enhance other classroom learning experiences. In order for the child to benefit from these experiences, it is essential that the teacher build the bridge between other related activities and the computer experience.

A second example of educational software that lends itself to creating learning environments in which to develop thinking and problem solving strategies, as well as research skills, is the program *Where in the World is Carmen Sandiego?* When the program begins, the child is a rookie detective with Interpol. A crime has been committed somewhere in the world by a member of a notorious gang. It is Monday morning and the child has until Sunday, 5:00 PM to track down the criminal. A *World Almanac* and a map of the world are provided for reference.

As the program progresses the child moves from city to city, interpreting clues, looking up facts in the *Almanac*, reading the map, and making decisions about what to do next. Each successful case is

noted on the child's record. Promotions are given and the cases become more difficult to solve.

This program is an excellent example of how to use the interactive capabilities of the microcomputer in a stimulating, fascinating way. Children become highly motivated to think, to puzzle, to conjecture, to read, to analyse as they use the program. It can be used effectively with small groups or by individuals. The benefits of the program are not so much in the exposure to a variety of facts about the world, but rather, in the process of using various strategies to solve a simulated problem.

A third example of educational software that promotes the development of thinking and problem solving is the programming language *Logo*. In *Logo* the learner has control of the computer and a "drawing turtle" through English-like commands. Discovering the effect of the various commands on the actions of the screen turtle, the child begins to experience the importance of sequence, syntax, and cause-and-effect.

The turtle graphics display of *Logo* is only a small part of the total environment. *Logo* provides a way to create new commands and store these for future use. A student may, over time, build a whole set of new commands that extend the built-in commands. The child may design a new command HOUSE that draws a house on the screen, or a command PLAYMARY that has the computer play "Mary Had a Little Lamb" on the computer's speaker. *Logo* is a medium similar to modelling clay or playdough. At the beginning level the user is able to produce simple, but satisfying representational objects. As the *Logo* user grows more skillful, the results of his/her work become more complex.

Through *Logo*, a learner may be given an opportunity to experience a structured approach to problem solving. The strategy of breaking a large problem into a series of smaller problems is one that *Logo* encourages. Also, as a learner builds new commands, there is the opportunity to constantly test and refine various problem solutions, as well as to detect and correct errors.

As was noted in the discussion of *The Factory* and *Carmen Sandiego*, the teacher creates the learning environment, identifies or creates the supporting learning resource material, and carefully crafts the experience to ensure that the connection is made between the computer activities/experiences and the intended curriculum objectives.

Learning Situations That Incorporate Computer Use

a. Patterning

Suppose that a group of children is working on recognizing and exploring patterns. The children may be using pattern blocks, unifix cubes, or different kinds of beans to lay out various patterns. They may be listening to and echoing a repeated sequence of sounds in a piece of music. They may be chanting a poem or modelling a repeating pattern of words from a favourite story as they write their own stories.

Or, they may be using a program like *The Pond* to discover a repeating pattern of lily pads that an animated frog would have to use to get across a pond.

Searching for patterns is an important element of the curriculum, an essential strategy of good problem solvers. Each of the experiences is designed to give a learner an opportunity to explore the concept and to internalize the experience. One experience is no more or less valuable than the other. A variety of experiences might be best.

b. Sorting and Classifying (Attributes)

Suppose that a group of children is working on classifications of objects by attributes. They might take a box of colored blocks and group them by color or shape, or sort them by size or quantity, or any combination of these activities. They may take a walk through the schoolyard and note the different kinds of trees. They may classify the different types of words that they generated together in a brainstorming session. Or, they might use a program like *Gertrude's Secrets* in which they solve a puzzle by organizing a set of colored shapes by color and shape on a grid.

c. Illustrating

While studying about Nova Scotia, a group of students might create a travelogue of an imaginary trip around some part of the province using the program *The Newsroom*. They might write stories of things they would see, create illustrations to accompany these stories, or create advertisements for businesses they might have seen on the trip. They could print the travelogue and display it in the reading centre in the classroom.

Using the same program, a group of students might create an illustrated glossary of the different pets owned by the students in their class. Each part of a page might include a picture and a write-up of a particular kind of pet. This example combines the concept of classification with writing, illustrating, and computer use.

" The teacher had a clear objective in mind and believed that the children could achieve the objective through the particular learning experience."

These are but a few examples of many ways that the microcomputer, with appropriate software, has been integrated into the curriculum. In each case, the teacher had a clear objective in mind and believed that the children could achieve the objective through the particular learning experience.

Organizational Strategies

Each use of the microcomputer may vary in terms of the best grouping strategy to use. A particular piece of software may work equally well in whole group, small group, or individual settings. A teacher may want to do some whole group brainstorming on various strategies for solving a particular problem posed by a piece of software. To do so, the teacher may connect the computer to a large video monitor and have the children sit around close enough to see the screen. The microcomputer is being used as an audio-visual device in

this case.

Many educational programs may be used by a small group or by pairs of children working in collaboration with each other. The same strategies and controls that teachers use with other grouped activities would be appropriate here. A child who is familiar with the program may act as a tutor for a child who is new to the program. Sometimes an older child may be paired with a younger one to the benefit of each. An older child (or teacher assistant), who is skilled at keyboarding may type a younger child's hand-written story into the word processor. After a conference with the teacher or other students, the partner might then assist the child to edit and print the story.

There are times when it is appropriate for a child to have individual access to a microcomputer, and maybe for an extended period of time. Writing using the word processor often should be done individually with opportunities to consult with others about the writing. Different computer programs may be very effectively used in every imaginable group situation - whole class, teams in class, individual, partners, teacher and student. The organizational strategy will depend on the objective for the lesson or related practice. The strategy will often change and adjust as dictated by increased familiarity and new objectives.

Time Commitment for the Computer Experience

As with other learning experiences, a session on the computer with a particular program usually will require some preliminary instruction and explanation. Each program is unique in this regard; some take longer to learn to use than others. Sometimes one child who has mastered the use of the program can teach another.

It will take longer for children to become comfortable with a complicated program like *The Newsroom* or a word processing program. It is imperative for teachers to realize that the objective is NOT to teach the computer program itself, but rather to teach those skills which are necessary to accomplish the goals of the intended learning experience.

Teachers will need to commit time to becoming familiar with the software and becoming accomplished in its use prior to using it with children. It is through hands-on experience as a learner that a teacher will be able to design the best experiences for the child.

S e c t i o n 3

Experiences of Classroom Teachers

The determination of appropriate uses of the microcomputer alongside other tools in the classroom is in its infancy. Classroom teachers are playing a critical role in making that determination. This section will present a number of reported experiences that classroom teachers in Nova Scotia have had using computers with children.

Elementary classroom teachers in Nova Scotia who had some experience using the microcomputer with children, were asked to write one page "scenarios". A scenario, for the purposes of this guide, is a concise description of a specific learning situation in which a microcomputer was used. The structure of a scenario is as follows:

Outline of a Scenario

Why?

What was the intended learning outcome of the situation being described? The intention may not have been totally clear at the beginning, but became clearer during the experience.

Who?

What are the characteristics of the learner(s)? Teachers were asked to include whatever was appropriate: grade level, age, sex, style of learner, or developmental stage with respect to the intended learning.

What?

What actually happened? Teachers were asked to describe the interaction between the learners and the learning environment - each other, teacher, materials, and the computer.

Implications

Teachers were asked to highlight both the benefits and pitfalls of the described experience indicating the possibilities for replication of the situation or possible spin-off activities.

The intent of each scenario is to document for other educators an idea or an observation that might serve as a catalyst for thinking about uses of the microcomputer. It is hoped as well, that writing a scenario might be a catalyst to trying out and documenting new experiences that could be shared with others.

The scenarios have been organized as follows:

The Computer as a Tool for Written Expression

Scenario Title	Author	Grade
1. Writing Using the Authoring Cycle	M.Harris	5
2. Writing Using the Authoring Cycle	J.White	5
3. Writing Using Language Experience	L.Caldwell	4
4. Writing - A Class Booklet	M.Yorke	4
5. Word Processing Class Booklets	R.Morse	5
6. Language Arts - Paragraphing	J.White M.Freeman	5
7. Telecommunications	A.Dawe	4-6

The Computer as a Tool for Illustrating

8. Printing Stories on *PrintShop*	D.Wheelock	P-1
9. Publishing a Class Newspaper	E.Meisner	6

The Computer as a Tool for Developing Thinking

10. Simulation Promotes Co-operation	K.Fraser	6
11. Math Challenges - Patterning	M.Marcoux	2
12. Directionality	G.Sexsmith	3
13. Team Problem Solving	F.Crouse	5-6
14. *Logo* Workshop for LD Children	J.Chisholm	5-6
15. Cross-age Instruction	J.Czapalay	P-6

1. Writing Using The Authoring Cycle - Mary Harris, North Woodside School

Why?

To promote writing from the child's own experiences and to extend these skills to include individualized reading and a co-operative approach to reading, writing, and thinking.

Who?

A class of 25 grade 5 students who had no experience with word processing. Their teacher was enrolled in a computer course and she was assisted by the computer co-ordinator.

What?

For the second term, there was one computer in the grade five classroom. The students were free to create their stories drawing on any topics from their personal experience.

Each child kept a writing folder. From time to time they left the word processor to join an author's circle to seek feedback. Each chose the piece of writing that he/she wanted published. After making corrections on the computer, they spaced the story out to allow for illustrations.

Implications

Interest and motivation was high. The children gained a great deal of confidence in sharing their ideas. They found the word processor enabled them to play around with the structure of language and to make corrections easily. Both teacher and students found that they were learning from each other.

2. Writing Using the Authoring Cycle - John White, Glooscap Elementary School

Why?

To promote writing from the student's own experiences and to extend these skills to include research, individualized reading, and a co-operative approach to writing-reading-thinking. The word processor was the tool used to stimulate reaching these skills.

Who?

A class of 27 grade 5 students who had no experience with word processing. Their teacher was familiar with computers, and he was assisted by the resource teacher who had just begun to use a word processor.

What?

The Authoring Cycle (a video tape series available from Education Media Services) was used as the curricular framework. For a six week period, there were three computers in the grade five classroom and nine in the resource center. Utilizing the tables in the library and an adjoining room, the students were free to create their stories drawing on any topics from their personal experiences.

Each student kept a writing folder. When they wanted feedback they joined an Author's Circle. Students took notes during the Author's Circle which they then used to help them continue writing. Each chose the piece from the folder that he/she wanted published.

After semantic and conventional self-editing, each student printed a copy of the writing, and took it to an outside editor (another student, teacher, or resource teacher). After making the corrections on the computer, the story was spaced out so that there was room for illustrations. *The PrintShop* was used to design the covers.

Implications

Interest was so high that the cycle continued. The children gained a great deal of confidence at sharing their ideas. While the authoring cycle can be carried out without computers, the word processor enhanced it. The students found it enabled them to play around with the structure of language and to make corrections easily. Both teachers and students found that they were focussing on the learning process, and learning from each other.

3. Writing Using Language Experience - Lloyd Caldwell, Tantallon Elementary School

Why?

To promote writing on concepts learned in a grade 4 social studies program. A language experience approach to understanding, reviewing, and writing about social studies concepts.

Who?

Two special education students integrated at grade 4 level social studies. Both students are capable of running the computer and word processing program independently.

What?

As a review, the students were instructed to create a story related to the social studies topic they were covering at the time. The story was to be fictional but facts from the topic had to be incorporated.

The first step was a brainstorming session in the classroom for ideas and key words to be used in the story. The students then went to the computers and using the word processor they completed a rough draft. The draft was printed out and brought to an author's circle consisting of the teacher and the two students. Suggestions were made as to possible changes to the stories. The stories were then revised on the computer and another copy made. The students returned to the author's circle for more feedback. If necessary, more revisions were made to the story. A final draft was then printed.

The students used *The PrintShop* for their cover graphics. The finished product was displayed on a bulletin board. The stories were saved on the students' personal disks. The students could return to their stories at any time to add additional information they had learned or to make other changes. At the end of each term the students bound their short stories together into a booklet entitled "My Social Studies Stories."

Implications

The format generated a great deal of interest in both the social studies topics and the writing process. The students were motivated to write by drawing upon the knowledge they acquired in social studies, using the easy-to-correct word processor, and the non-threatening author's circle.

The students gained confidence in themselves from the success experienced in recalling and writing on a particular topic. The quality and quantity of the writing increased as experience and self confidence grew. The students were proud to display their work and encouraged other students in the school to look at it. One drawback of the process is the amount of time it took to key the words. With practice, keying time should decrease. Follow-up activities could include acting out stories and research projects.

4. Writing A Class Booklet - Margaret A. Yorke, Grosvenor-Wentworth Park School

Why?

The intent of this project was to provide the students with the opportunity to type and edit a story on the computer and have it published in a class booklet.

Who?

This activity involved 27 grade 4 students, most of whom had no experience with word processing. The *Bank Street Writer* word processing program was used.

What?

Each child typed a story of his/her choice into the computer. With the help of a partner and the teacher, each child revised his/her story. Each child would do a print-draft which would then be edited for errors. Using the word processor, the children edited the text using these corrections and suggestions.

Several children submitted a design for the cover of the booklet. The class voted on these and the cover was made using *The PrintShop* program.

This process took most of the three months the computer was in the classroom.

Implications

This was a rewarding experience for the children. They enjoyed seeing their stories in print. Each child was given a copy of the story for his/her creative writing folder.

Several of the children became very good at editing and enjoyed being asked to help a classmate.

It was very time-consuming as it took a long time for many children to type their stories. They were not familiar with the keyboard. Editing also took a great deal of time.

It would be better to have the computer for a longer period and to have spent some time in the beginning on keyboarding skills. Having the computer for four to five months or longer would allow the children more time for keyboarding and composing at the computer.

5. Word Processing Class Booklets - Ruth Morse, Grosvenor-Wentworth Park School

Why?

To produce a booklet of original prose or poetry using a word processor. Each member of the class is to produce one piece of work.

Who?

A grade 5 class of 26, 10 years of age, mixed male and female, originally working in pairs, the more experienced paired with the less experienced. After the initial week, children worked on their own but were able to call on peer "experts" for help. The peer "experts" did most of the retrieving and saving of text to disk. The class had the computer for three months and used *Bank Street Writer*, *Spellwriter*, and *The PrintShop*.

What?

Children signed up for half-hour periods throughout the school day plus before and after school and during lunch hour. Peer "experts" retrieved and saved work from disks. After the work was finished, peer editors helped edit work; the teacher was the final editor. Loading of programs and most use of the printer was done under teacher supervision.

Implications

The benefit was seen in students' writing and composing. Some typing skills were learned and graphics were employed. One of the pitfalls is that children cannot type with much speed or proficiency. Even with the typing program, there is too little time for practice. Toward the end of our session with the equipment, there arrived in the school, for the benefit of grade 7, a bank of 17 computers. This was beneficial for the purpose of mass instruction with the *Bank Street Writer* program. I did find it difficult to carry on a regular class program and also instruct or assist in computer. The peer helpers were very helpful. In spite of the pitfalls, the children certainly learned from and enjoyed their word processing experience.

6. Language Arts Lesson on Paragraphing - John White & Murray Freeman, Elementary Task Force

Why?

To show students how paragraphs indicate a change of action or new dialogue by editing their own stories.

Who?

Grade 5 writing class working with individual student's work on the computer screen.

What?

At this level students tend to write from the top down without regard for change of action or thought, resulting in one long paragraph. When the student had completed entering the text, the word processor offered a very effective way of breaking the writing into paragraphs at the appropriate places. The teacher used this moment to show that change of action or shift in dialogue should have begun a new paragraph within the student's work. When the curser was placed at the position where the new paragraph should have begun, a simple *Return* shifted the remaining text down to begin a new paragraph.

Implications

This is a flexible editing feature which allows the student to view the effects of the new paragraph. If it doesn't suit, then further changes can be made by simply removing the *Return* and inserting it elsewhere. By sharing this technique directly with the student or partner pairs, the teacher is able to explore the very abstract concept of paragraphing in a clean, clear, visual way.

7. Telecommunications - Alan Dawe, Atlantic Memorial School

Why?

To give students an opportunity to write and provide motivation and desire to communicate. To provide students with resources and ideas from other communities.

Who?

Students from grades 4 to 6, including some students recommended by the Resource teacher.

What?

Students used a modem and Maritime Tel and Tel *Envoy 100* message service. A network of schools was created with an overall administrator to help bring new schools on line and initiate contact. Students composed messages on-line which were posted in the "electronic mailbox" of the receiving school. Messages (text) can also be word processed on another computer and then sent later over the telephone line. Text received from other schools can be printed, and given to the appropriate students.

Implications

Students began by using the message service to establish pen pals. Because of the immediacy of the communication, one student was able to manage several pen pals from different schools. Students exchange ideas and information about schools, community, and self.

A tremendous volume of text was sent and received during one day, far too much for one teacher to organize and control. This duty was given to the students and each established a personal file of text sent and received. Beside the electronic mailbox, a bulletin board was established that electronically posted a message for all network users to read. This was valuable as a way to exchange opinions and ideas without establishing personal contact. Math puzzles, work games, poetry writing, and "add to the story" activities all became part of daily communication. Several experts were also part of the project (a math professor and a professional author). Students used these people as resources.

A great variety of language arts skills was developed and/or enhanced by the activities. Students with little or no motivation to write began to produce much better work. Good language arts students used the network to communicate their ideas to an appreciative and almost always receptive audience.

8. Printing Stories on PrintShop - Daphne Wheelock, Birchtown Consolidated School

Why?

The intended learning outcome of this situation was twofold: (1) to promote writing stories relating to the theme of Outer Space and (2) to become familiar with the procedure involved in printing the stories on the computer using *The PrintShop*.

Who?

The scenario involved a class of 25 grade P-1 students who had become adept at operating the computer using various programs, but were not familiar with the use of the printer. Each child worked at the computer with the help of a peer tutor. Several accomplished tutors had been appointed.

What?

In a whole group setting, *The PrintShop* was demonstrated with the teacher actually typing and printing her "Outer Space" story from a rough draft. Children were given a rough paper and time to write and no further motivation was necessary. Stories soon piled high on the computer ready for printing. Tutors helped each student read instructions when necessary, make and understand choices regarding main menu, border, graphic, and graphic size, layout, font, etc., by using excellent questioning techniques.

This was a very exciting experience for all children. Each seriously typed a story concentrating heavily on the keyboard for the first printing. However, each revealed better eye-contact with the monitor the second time around, when they were expected to type and print a second story with little or no aid from the tutor.

After serious concentration on typing, each child "giggled" through the excitement of watching his/her story being printed. Each usually asked for two copies. Both were mounted on construction paper and one was taken home to share while the other was shared with the class, displayed, and later stored in a story folder.

Implications

Children were so highly motivated that many started writing rough stories at home and bringing them in the next day for printing. Instruction from a tutor saved valuable teacher time and helped most children to become independent operators of the printer. Time lost in initial learning soon reaped greater outcomes. Value was also realized through use of oral communication skills with the tutor and solving problems involving appropriate choice of main menu, border, graphics, layout, and type of print.

Follow-up activities involved each primary child writing and printing a page for a pattern big book titled "Thirteen Days in Outer Space" (patterned after the The Twelve Days of Christmas); and each grade one student writing and printing at least two pages for a "Spaceabet" big book patterned after the alphabet. (e.g., A is for Marc Garneau because he was the first Canadian astronaut.)

9. Publishing A Class Newspaper with The Newsroom - Eric Meisner, Coldbrook & District School

Why?

The intent of this activity was to promote interest in writing, to create a bigger student awareness of activities, events, and personalities in the school, to learn the skills of interviewing, investigative reporting, and editing, and to create a forum for displaying writing done by the students.

Who?

This activity involved a class of 25 grade 6 students who had limited experience with word processing and had not previously been taught interviewing or reporting skills. They had access to the classroom computer and printer.

What?

Students were going to create a weekly newspaper using the program *The Newsroom*. Two fifteen-minute journal writing classes were set aside each week for the project. Initially, students were given a suggested list of topics on which to write by the teacher. Students who chose not to write a newspaper article wrote a regular journal entry. Stories, interviews, reports, poems, and articles were read by the teacher and returned for suggested changes or corrections. When more than one student submitted a similar article on the same topic, these students met as a small group, and with teacher assistance, amalgamated their reports into one. All students were taught the basics of how the program worked, but a writing team consisting of the teacher and four students were selected to transfer the articles into newspaper format on the computer. This team initially chose accompanying clip art for the articles; but as student awareness of the program increased, they began to choose their own. Indeed, on occasion a story would be written to suit a particularly favored piece of clip art.

Implications

This project started as a weekly project in late September and interest remained high well into the new year. It could be used with success in most classrooms from grade 4 up as long as the following concerns are addressed: all students must be published from time to time, not just the better students' submissions; the project cannot become the work solely of the writing team (it is felt that the program is too complicated for all students to learn comfortably and to attempt to have each student type in his or her own article would be too cumbersome and time consuming); the teacher must work to motivate students to write each week, particularly in those weeks when it seems nothing of note happened, because interest may soon wane once issues are missed.

10. Simulation Promotes Co-operation - Kathryn Fraser, Tower Road School

Why?

What began as the sharing of a stimulating and high-interest game, *Where in the World is Carmen Sandiego?*, developed into specific learning opportunities. The experience provided an opportunity for working co-operatively, for learning about other countries, for skimming for information, and for using general knowledge to solve problems.

Who?

About 18, highly-motivated grade 6 boys and girls took advantage of the program *Where in the World is Carmen Sandiego?* All had had previous experience with computers. Many had travelled and had above-average general knowledge of the world. Reading ability ranged from below grade level to well above.

What?

The students worked in groups of three and took turns keyboarding, manning the map, and using the almanac. They chose their own partners and no attempt was made to organize them by ability groups. The groups, once formed, remained stable.

The computer was near the teacher's desk so that she could listen to their conversation. Interesting group dynamics developed. Team spirit and working towards a common goal was much in evidence. It was pleasing to hear a student, who had difficulty reading, able to tell more able students all about Sri Lanka. It certainly helped his self-esteem.

Note-taking was spontaneous and was closely linked with an on-going study skill's priority. At times, they became frustrated with the inability to correct mistakes. However, this became a positive learning experience in that they became more careful and checked their input. They discovered that proof-reading had a practical purpose. This did not hamper their enthusiasm to suggest and experiment, and they tried to agree before pressing *Return*.

Implications

Besides the benefits mentioned, this program has considerable potential for spin-off activities. It could provide characters, plots, and details for story writing. In social studies, it lends itself to researching, comparisons, and map skills. It appears to be the kind of activity that could transfer to other areas of the curriculum by building self-confidence and developing research skills. Evaluation of the learning is difficult. The speed at which the cases are solved is one indication of progress. The best method seems to be anecdotal through teacher observation.

11. Math Challenges: Patterning - Marianne Marcoux, Ecole Beaufort

Why?

The intent of this scenario was to provide an opportunity for students to formulate strategies in order to discover the pattern in a problem. *The Pond* was the program that was used.

Who?

A group of math students from grade 2 were invited to use the computer in the resource room for math-related games which involved problem-solving skills. Students were selected by their classroom teachers and worked under the supervision of the resource teacher. In total, 16 students worked in groups of two during a 30-minute session each time.

What?

For some students this was also an introduction to the computer keyboard and some of its keys. The students were introduced to *The Pond* at the two-step pattern level. We began with the practice option, which is a good introduction to the program, and then proceeded to the game option where they could continue to work with their partner or compete one against the other. The objective of the program is for the students to help a frog jump along a maze of lily pads arranged in a pattern. To reach the magic lily pads at the end of the pattern, the student must be able to identify and type in a pattern that will make the frog jump through the pond without falling into the water. For those students able to handle a more challenging problem, we proceeded to a two-step pattern with distractors or a three-step pattern.

Implications

Working with a partner created a safe, no-risk environment. Students took turns typing in the pattern and relaying the information to their partner who acted as a scribe writing down the pattern as it emerged and offering assistance. Even when we switched to the game option where students are competing with one another, they continued to offer assistance and help. The graphics and sound are greatly appreciated by the students. Although most students caught on fairly quickly, not all of them could solve a three-step pattern without some teacher intervention. *The Pond* is an excellent program for the development of pattern recognition, prediction, logic formation, directional sequence, and risk-taking skills. Students could continue with this program for some time since higher skill levels involving four-step patterns with distractors are part of the program.

12. Directionality - Gail Sexsmith, Brookfield Memorial School

Why?

Students were given an opportunity to write a small set of instructions which would draw a shape on the screen. It was hoped that there would be an improvement in their sense of direction, regardless of position of the drawing image on the screen.

Who?

Twenty-two grade 3 students, both sexes. Pairs of students had been using the *Kidstuff* program (now called *Turtle Tracks*) three times a week for about five weeks. (Note: *Kidstuff* is a small version of *Logo*.)

For this activity individual students took turns on four keyboards. Most of the students had been quite successful at following the directions on the *Kidstuff* lessons. Little teacher intervention had been needed.

What?

Eight of the students drew their diagrams on grid paper, wrote the program and successfully ran the program on the computer. Some of the others managed to write the program but needed help from the teacher or other students in sorting out the directions. Four had no idea what they were supposed to be doing, and seemed very reluctant to ask for help.

Implications

Obviously not all students had benefited from the *Kidstuff* program in terms of directionality. Most had some concept of how programs were set up.

The successful students were quite anxious to try again and a few became frustrated waiting for a second turn at the keyboard, the unsuccessful students having used up more than their share of the allotted time by attempting to do programs that were too long and complicated.

This experience showed me that more time should be spent with those students who were experiencing difficulties. Running through a few more example programs would probably have helped most students.

13. Team Problem Solving - Fred Crouse, Department of Education

Why?

The intent of this scenario was to provide an opportunity for students to solve problems as a team.

Who?

A group of 12 grade 5 and 6 students, both sexes. The students had completed a unit of study on *Logo*. They had not seen the program *The Factory* prior to this experience.

What?

In a whole group setting, the first two levels of *The Factory* were demonstrated. Students were encouraged to talk about what to do next while the teacher carried out the actions. Three computers were available, so the group was divided into three groups and each group was sent to a computer. They were told to create a product (level 2) and leave just the product on the screen. When all groups were ready, they rotated to the next computer and attempted to solve the problem left for them by the previous group. Most of the stated objectives of *The Factory* were evident, but, in addition, some interesting group dynamics took place. The enthusiasm to participate, to suggest, to experiment seemed to be motivated by this unique environment. Students who were strong non-verbal tended to be the stars in this activity.

Implications

Providing an opportunity to work as a team in an environment in which it is easy to experiment and to correct seemed to encourage participation. The discussions between team members demonstrated a wide range of problem-solving strategies. Follow-up activities might include discussing these strategies, talking about how to share responsibilities, how to involve reluctant team members, and how to draw on the strengths of others.

14. Logo Workshop for Children with Learning Disabilities - John Chisholm, Shannon Park School

Why?

The workshop was set up to allow students who have experienced difficulty in the area of mathematics to explore geometric concepts using *Logo*. The motivation of using the computer was looked upon as a possible positive influence on the attitude of the students toward mathematics.

Who?

The class consisted of 18 students aged 11-13 who had been identified as having a learning disability.

What?

The workshop consisted of one one-hour session per week using *Logo*. The students worked in teams of two or three. Each team were required to complete the following assignments: create a figure, create a design, create a flag, and create a real-life picture. All of these assignments were open-ended in that the students were free to approach the assignment in any manner they chose. In addition to these assignments, mini-experiments were set-up so that the students could explore some of the specific features of *Logo*.

Implications

The students began to make connections between their "play" with *Logo* and the geometric concepts of mathematics. Many of the students made statements such as "That's what we're doing with *Logo*." They learned geometric concepts that their peers in the mainstream grade 6 classes had not.

There appeared to be a change in attitude within the students toward math. This was demonstrated in the ability of the students to attempt activities within the grade 6 math program that in past would have overwhelmed them. There was a sense of confidence in themselves that wasn't apparent earlier in the school year.

15. Cross Age Instruction - Joan Czapalay, Shelburne County District School Board

Who?

To observe learning behaviors in children of different ages when exposed to instruction for which they had little or no prior knowledge.

Who?

Four elementary school pupils ages 6, 8, 10, and 12. The students would be introduced to the computer using *Logo*.

What?

Initially, the pupils were told that they would be able to work together at the computer but each would use the computer to produce a geometric design. To do this the group would need to agree on the meaning of some terms. The pupils using the tiles on the floor were able to move to the right, left, turn, and so on. They were then given an opportunity to try to use *Logo*. None of the pupils had had any computer exposure prior to this. The group came to agreement about taking turns with no teacher input.

All four children self-corrected and peer corrected unselfconsciously. Each chose a design appropriate to his/her level of ability; each seemed proud of his/her own work. The timid 8 year-old received a lot of support, the 10 year-old was the acknowledged group expert, the overly active 6 year-old used patience and behaved maturely, the 12 year-old gained confidence and was spokesperson for the group. All completed the assignment in the planned number of sessions (four noon hours). At the conclusion of the project each child was to share with one other from the school.

Implications

The children demonstrated social relationships. They were able to problem solve with people from other grades and other ages. In using language they learned that sometimes they had to agree on a particular word meaning, instructions must be clear, errors are not crimes but simply errors and usually correctable, and talking with each other helps learning. The teacher's role is changed. This gives a teacher a chance to observe and listen to the learners and plan instruction based on these observations.

A Call for More Scenarios

Classroom teachers reading this document, who have had an experience using the microcomputer with children that they are willing to share, are asked to write a scenario based on the models presented here. Teachers submitting scenarios should refer to the outline presented on page 9. These may be forwarded at any time to:

Computer Education Consultant
Curriculum Division, Department of Education
Box 578, Halifax, NS, B3J 2S9

The Department of Education reserves the right to edit, publish, or not publish the scenarios submitted.

S e c t i o n 4

Software Considerations

The approach to computer instruction being advocated throughout this guide is dependent on the availability of good quality educational software. As various types of software are used on a microcomputer, the machine becomes various things. It can, for example, be a writing tool, a communications device, a calculator, a repository of information, or a problem poser. It might simulate the cockpit of an aircraft, the eyepiece of a telescope, or the drawing pad of a graphic artist.

The level of sophistication of educational software has grown tremendously over the past few years, and yet, this progress has made software easier to use. Some of the early pieces of software exemplified an attempt to move a paper-based learning experience into an electronic form. These might be called the "electronic page turners": *Press Return to Continue, Press Return to Continue, Press Retu...* The state of educational software development is now such that educators should demand that all learning experiences presented through a microcomputer be valuable and appropriate uses of this medium.

Characteristics of Good Quality Educational Software

The Nova Scotia Department of Education has co-operated with the other provincial departments of education through the Council of Ministers of Education, Canada, to establish a common set of educational software evaluation criteria. These criteria are available through the Curriculum Division, Box 578, Halifax, NS, B3J 2S9.

Generally, educational software should exhibit the following characteristics:

- have clearly defined and attainable objectives that match the guidelines in *Public School Programs*;
- provide an experience that supports and enhances learning;
- present content that is appropriate in scope, sequence, and depth;
- provide an appropriate and motivating interaction with the learner;
- be easy to start up and operate;
- run properly and correctly; and
- provide appropriate support documentation written at the level of the intended learners.

Using these criteria, the Nova Scotia Department of Education has established a process to identify and evaluate educational software using the criteria noted above. Following evaluation, it may be listed for purchase from the Nova Scotia School Book Bureau using textbook allocation funds. Evaluation reports are regularly mailed to district school boards for distribution. Teachers should contact the school principal or the district school board office to see these reports.

Copyright and Copying

Only the author or present owner of the copyright has the right to duplicate and distribute a work. Unless specifically given the right by the producer, the purchaser of a software package does not have the right to make additional copies. Some software developers have granted these rights to the end-user, but the majority of developers have not.

Discussions concerning whether a piece of software can be duplicated by some sophisticated copy program or whether the costs of software are too high are irrelevant. Unauthorized copying is illegal and morally wrong.

The general aim of public education in Nova Scotia includes "enabling students ... to make sound judgments, and to discriminate among values." For educators to use or to have students use illegally obtained classroom materials would clearly prevent the achievement of this aim. Teachers and school administrators should be very clear about the rights to use and the rights to copy software that they purchase.

Software Packaging

Some educational software developers have recognized the unique problems of providing appropriate quantities of software at reasonable cost in schools that may have numerous microcomputers. Lab packs and site licenses are two attempts to address this issue. A lab pack may consist of additional copies of the program disk at a reasonable cost. A site license is a permit to use and make copies of software to use on a site, usually defined as a school building. Sometimes a site license may be sold to a district board for the full district. Whether that is a cost effective choice depends on the cost of the license and the number of copies of the software needed by the system.

Software Warranties

It is an observed fact of life in elementary schools that computer disks may become unusable. Peanut butter on the disk, or finger prints, or numerous other common occurrences may mean that a significant investment in software is lost. When deciding to purchase software, it is important to discover how many copies of the program will be provided and what the replacement policies of the software producer are. Many companies provide only one copy of the disk, maybe a back-up copy, and a replacement policy of 90 days if the program is defective. Other companies provide two or more copies of the disk in a package and a life-time warranty no matter what happens to the disk, including misplacement or theft.

S e c t i o n 5

Hardware Placement and Characteristics

The experiences in using microcomputers in schools would indicate that no one physical arrangement is best. School personnel will need to decide on the organizational structure that best suits the needs, the intended use, and the physical layout of a particular school. The two most common arrangements found in elementary schools are either a central location housing all of the school's equipment (the resource centre approach), or a parcelling out of available equipment to various classrooms. Each approach has inherent advantages and disadvantages which should be considered

The Resource Centre Arrangement

Advantages:
- when resources are limited, a larger number of workstations can be made available to larger groups for instruction;
- through careful scheduling, everyone in the school may enjoy a fair allocation of available workstation time;
- sound from programs is less likely to distract other learning activities; and
- generally one teacher will take charge of repairs and supplies.

Disadvantages:
- necessitates a rigid schedule which encourages the teacher to plan for computer activity as a thing apart from regular classroom activities, rather than an activity which flows naturally out of the regular program;
- may discourage teachers from using the computer as a tool for the "teachable moment";
- a rigid schedule may prevent daily access for text editing as an integral part of the daily writing program;
- transition times to and from the resource center may be lost to the program; and
- the room allocated for the computer resource centre may be lost to the school for other uses.

The Classroom Arrangement

Advantages:
- workstations are generally immediately accessible to the students in that class;
- computer learning activities can flow from classroom activities;
- scheduling of students at workstations can be more flexible to accommodate daily adjustments to planned program;
- students are encouraged to be independent users of computer at times when teacher is pursuing other activities with other students in the classroom;
- a computer is available for demonstration within a lesson most of the time; and
- students see the computer in the context of a "tool among tools"

once it becomes a fixture in the classroom.

Disadvantages:
- where resources are limited it may not be possible to have a large group or class at the computers simultaneously;
- students at the computer may distract students pursuing other learning activities within classroom;
- if the teacher's main focus is on other learning activities in the classroom, students at the computers may be deprived of immediate correctives and feedback;
- students from other classrooms may be denied access at times when the classroom is busy but the computers are not; and
- no single person may be responsible for repairs and supplies unless so designated.

Characteristics of Elementary School Computer Equipment

Principles of Hardware Selection:
- *Software determines hardware*
- *Use determines the configuration*
- *Cost and volume of equipment must be in balance*
- *Avoid the bandwagon approach Look for "upgradeability"*

Educators from the classroom to the school board office wish for a crystal ball to indicate the future trends in hardware development. (Refer to *Education Nova Scotia*, Vol XVI, Number 4 for greater detail.) With the rapid changes and quantum leaps in sophistication of hardware, decisions concerning appropriate hardware should be based on the following set of principles.

Software determines hardware. The approach to computer education advocated in this guide depends on having good quality educational software available. The types of equipment for which the greatest volume of educational software is available must be considered.

Use determines the configuration. All educational software is provided on disks, therefore educational microcomputers need disk drives. With the emphasis on word processing and other publishing software, printers need to be readily accessible. Much elementary school software depends on color and will need color monitors.

Cost and volume of equipment must be in balance. Equipment that is so expensive that a school system can afford only a few machines will not meet the needs or demands of learners. Inexpensive equipment which cannot run the good quality software noted above is a waste. A balance must be found between getting enough equipment to provide adequately for all students, and ensuring that the equipment will do the job.

Avoid the bandwagon approach. It can be assumed that equipment will change and that innovations will be developed. With the amount of funding available to school systems, it would not be wise to jump on each new bandwagon as it comes by. It may take several years before a new microcomputer is supported with a reasonable amount of educational software.

Look for "upgradeability." If possible, equipment should be able to be upgraded at a reasonable cost. This might be accomplished through software upgrades or by changing some part of the hardware.

The Room

Unlike large mainframe computers, microcomputers do not require specially designed rooms with air conditioning, dust control, or special wiring; although chalk dust can be damaging to disks and disk drives. These machines do not draw very much electricity; however, each machine may require several outlets with a filtering device designed to remove voltage surges. In a resource centre setting, provision could be made for a master switch which can control all outlets. This makes it easier to be sure that all machines are shut off at the end of the school day. This switch should be controlled by locking, or some other method, so that an accidental (or deliberate) power interruption may be avoided.

In a classroom setting, care must be taken to ensure proper connections to a power source without interfering with student movement or safety. School systems must ensure that devices used, or connections made, meet with CSA standards for schools. Proper grounding must be ensured.

Microcomputers should be housed on desks that are large enough to provide room for the equipment as well as a workspace for the students using the equipment. The tables should be of proper height for the children who will be using them, and should be adjustable. Elementary schools might consider mounting the equipment on desks that have lockable wheels. These would allow for flexible placement and usage of the equipment.

Disk drives and printers should be easily accessible and provision should be made for feeding paper into the printer. An inexpensive solution is to construct a small stand for the printer and place the paper under the stand. A piece of discarded carpet under the printer makes a good sound insulator. Cables and power cords need to be kept under control. If the printer is in a classroom, consideration should be given to purchasing a sound-insulating cover. Printers are noisy.

No special provisions for classroom lighting need to be made; however, glare or direct sunlight may need to be avoided when placing computers around the room. Static electricity can cause various problems with both hardware and software. For this reason it is not advisable to house computer equipment in carpeted rooms unless special arrangements have been made for controlling static.

Maintainence

The most susceptible parts of the systems that have been used in Nova Scotia have been the power supplies and the disk drives. School systems should plan and budget for some maintainence costs. Someone in the school will need to take responsibility for the equipment.

Special Devices

Add-on devices are being produced for microcomputers constantly. Some of these devices have particular application in elementary schools and with specific learners. Devices like joysticks, mice, graphics tablets, and light pens provide alternatives to the keyboard for communicating with the computer. Alternative keyboards that have large keys and flexible configurations may have specific application for certain learners.

Handicapped students can enjoy access to this technology if special adaptive devices are used. Current information can be obtained from the Izaak Walton Killiam Hospital or the Microcomputer Resource Centre at Education Media Services.

For whole group instruction, a large display device is a necessity. This device may be a large video monitor or it may be a video projector. Care must be taken to ensure that the computer being used can be connected to the large display device and that the display is readable. Problems of visibility similar to the difference between 16 mm film and video tapes will be encountered. Contact Education Media Services for details and assistance.

Financial Considerations

Acquiring enough computers to meet the growing demand in schools requires both patience and careful planning. It is unrealistic to expect that all equipment desired by school personnel will be purchased at the same time.

Beyond the normal schools budgets, districts are sometimes able to purchase quantities of equipment through special sources of funds. The equipment could be shared among the schools in the district on a regular schedule.

Fund raising in the school and community may also be a significant source of equipment. Home and school associations, service clubs, students councils, computer clubs, and like groups have proven to be a consistent and substantial source of support for computer equipment projects.

S e c t i o n 6

District Level Planning

Curriculum implementation is the responsibility of the district school boards in Nova Scotia, with support and assistance being given by the Curriculum Division of the Department of Education. With the approach of using the computer as a tool for learning being advocated in these guidelines, it is essential that careful thought be given to the process of implementation at all levels. A number of factors must be considered, including the present and future training of teachers and principals; the availability and distribution of hardware; and the provision of appropriate software.

An Implementation Plan

An Implementation Plan:
- *Assessment*
- *Reflection*
- *The Plan*
- *The Implementation Cycle*

Section 1 of these guidelines re-states the goals of education in Nova Scotia and expands these goals into a set of objectives. The curriculum plan for implementing a strategy for computer use in elementary schools must address those statements and define the process by which they may be achieved. The plan should be based on the available resources and should be realistic. A method of evaluating and revising the plan should be included. A set of suggestions to be considered when developing the plan follows:

Assessment

District board staff responsible for curriculum planning at the elementary school level should review these guidelines and any present policy or philosophy statements of the district board with respect to computer use in elementary education. A process of data collection should be undertaken to address the following questions:

1. What is the present level of expertise and training of all staff at the elementary school level? Who are those individuals who are most likely to be the leaders and innovators in this endeavor? Who are willing to lead or innovate, but will need support?
2. What implementation has already taken place? Where? How does it compare to these guidelines?
3. What is the present inventory of hardware available at this time? What equipment can be allocated by the district board?
4. What is the present inventory of software within the district?

Reflection

Based on this assessment and review, curriculum planners need to reflect on some of the following questions:

1. Where is the district with respect to the directions in these curriculum guidelines? What are reasonable goals for implementation this year? in the next three years? in the next five years?
2. What approach to computer education will this district adopt?
3. What are the major obstacles to implementation? What decisions have to be made, and at what level?
4. What links are there to other current curriculum planning?

The Plan

A reasonable and responsible plan needs to be developed that addresses these issues. Involvement of teachers and school administrators in the development of the plan is highly recommended. The plan should be publicized and opportunities to respond should be given before implementation begins.

Implementation Cycle

A continuous cycle of implementation, evaluation of the implementation, revision of the plan, and implementation of the revision should be adopted. The evaluation of the implementation should address the question "Is the curriculum implementation achieving the stated educational objectives?", not, "Is the curriculum guide being implemented?"

District Level Support

To provide additional support for the implementation of these guidelines, it is recommended that district boards establish a centre or clearinghouse for current information on curriculum, teacher training, software, and hardware. This centre may be the office of a curriculum supervisor or a part of an established teachers' centre. It is recommended that copies of current and new software be purchased for such a centre, and that these be made available to teachers for previewing or use. Hardware inventories might be maintained and teacher training sessions organized through this centre. Current software evaluations and access to other resource information might be provided.

Section 7

Teachers' In-service Training

In planning for the implementation of the recommendations contained within these guidelines, it is essential to pay close attention to the needs of the present teachers in Nova Scotia and of those individuals involved in pre-service training. The objective in teacher preparation for computer use must be to make teachers comfortable with the technology. If teachers are to use this technology effectively, they must gain a sense of control. Teachers should be expected to use computers with children only after they have been able to gain confidence in their own abilities.

It is a myth that teachers will need to become computer specialists in order to make effective use of microcomputers within their teaching. It is true that they need to develop the ability to control the machine themselves and to perform simple trouble-shooting functions. However, they do NOT need to learn how to program or repair a computer, or to write their own software. For most educational software, both the teacher and student need learn no more than how to load the program and which keys to use to operate the program. The amount of time this may take for some teachers should not be underestimated.

The Role of the School Principal

As with any curriculum innovation, the key person within the school is the principal. The principal is in the position of having a wide view of the effect of curriculum innovation across the school, yet is close enough to the classroom to be a facilitator in implementing curriculum change. In-service programs designed to assist with preparation of teachers for this guide must include the principal as a full participant in planning and implementation. Principals and staff must work together to assess their needs and to plan strategies for addressing those needs. Much of the in-service effort will need to be within a given school building with continuing opportunities for follow-up and additional in-service programs.

In-service planners should consider both the curriculum leadership role and the administrative role as they prepare to train school administrators. Many of the activities outlined here for teachers are appropriate in-service experiences for administrators as well, particularly those involving the use of utility programs. The word processor, database programs, and electronic spreadsheet programs are the basic tools of the modern, electronic office.

In addition to giving administrators these hands-on experiences, some attention to curriculum planning and change in light of the potential impact of classroom computer use is appropriate. Discussions on how to organize access to the equipment; lab versus classroom placement; software acquisition and control; hardware acquisition and repair; and teacher training are appropriate topics for discussion.

Teachers as Computer Users

The early experiences with using computers in education in Nova Scotia have indicated that one of the determining factors of successful implementation is the classroom teacher's facility with the computer. Those teachers who have become confident users of the microcomputer in their own professional and personal work, have tended to be more comfortable about using the machines with their students. This use may be as simple as using the word processor or printing programs to produce classroom materials and tests. Moreover, some teachers have begun to use database programs for marks and record keeping. While these applications are administrative in nature, the teacher who uses such programs is building confidence and comfort with this technology.

In-service programs for teachers should provide instruction in the use of the word processor as one of the beginning activities. Teachers need to have access to the machines over a period of time, and at their leisure, following the in-service program in order to allow the process to become natural to them. Consideration should be given to making equipment and software available in a teachers' work area or on a sign-out basis.

The time and attention given to developing a teacher's ability to use the computer in a variety of ways is time well spent. In the early stages of teacher training, it is essential that the pace be slow. Teachers need time to absorb the processes and to gain confidence.

Teachers Using Curriculum-Based Software

Teachers know their children and the curriculum. They are in an excellent position to make the judgment about the appropriateness of specific computer related learning experiences. Software developers are beginning to recognize that educators are becoming discriminating consumers and, as a result, are more sensitive to the type and quality of software that teachers are demanding.

In-service programs should provide teachers with an opportunity to examine for themselves the alternative teaching approaches possible with educational software. Teachers should be encouraged to make judgments about where the software fits in the curriculum, the appropriateness of the learning experience presented by the software, and the potential for implementation. Teachers should be encouraged to be critical and not to be dazzled by the technology.

If the plan for an in-service program is to give teachers an opportunity to "try-out" software, it is strongly recommended that just a few, carefully selected pieces of software be made available. To appreciate both the acceptable and the unacceptable implications of software use with children takes time. Teachers should be given the opportunity to discuss their experiences with others. Plan ahead to have someone in the group become very familiar with the software prior to the in-service session. Follow-up activities should provide

more time and access to the same or similar software. Teachers should not be made to feel compelled to use computers, but, rather, should be encouraged to make decisions about appropriate uses of the computer.

A Proposed In-service Plan

An in-service plan for a school or district must begin with a needs assessment to see where the teachers are with respect to their personal computer use and their knowledge of educational software. From that assessment the appropriate starting point for each teacher can be determined. The following is a suggested model and sequence for teacher training.

An Inservice Plan:
- *Introduction to a Word Processor*
- *Time and Access*
- *An Extension of the Word Processing Experience*
- *Experience with Curriculum-based Software*
- *Implementation, Integration, and Application*

Introduction to a Word Processor

Initially, teachers should be involved in writing exercises using this electronic medium. Detailed instructions on how to use a word processor can be given within the context of the writing exercise. The objective should be to have teachers produce a finished, printed copy of their writing as early in the learning experience as possible.

Time and Access

Encouraging teachers by allowing enough time to produce something of practical value on the word processor is essential. It may be a test, a hand-out, a letter to a parent, a useful form, or something else. Teachers should be encouraged to share their experiences with each other. Direct access to the equipment and software for a period of time following the in-service day should be facilitated.

An Extension of the Word Processing Experience

Providing an opportunity to talk about the early experiences and to share successes and failures is an important component of the in-service plan. Additional instruction on editing, cutting and pasting, formatting text, and disk management should be given. Discussions on the implications of this type of writing environment for teachers and students should be encouraged. Teachers might be shown a spelling checker or a grammar program at this stage.

Experience with Curriculum-Based Software

Presenting a piece of general purpose educational software to a group of teachers is an excellent way to develop awareness of the present level and direction of software development. A discussion which centres on the qualities of good software and the place of educational software in the curriculum would be of value.

Following this discussion, teachers should be given an opportunity to try several pieces of software that have specific application to their teaching assignment. Enough time should be given to let them become very familiar with the software. Opportunities to discuss their experience with others should be provided.

Software that looks promising should be loaned to the teacher for a

period of time so that they can investigate it further and try it with students.

Implementation, Integration, and Application

A specific in-service session focussing on integrating the microcomputer into the curriculum should be held. Teachers who have attempted to involve children with computers as part of their teaching should be encouraged to share their good and bad experiences. As part of the in-service program, teachers should be encouraged to plan carefully, taking care to start slowly with a manageable project. Follow-up activities should provide opportunities for continued sharing and joint planning. Teachers might be encouraged to write and share scenarios similar to those presented in section 3 of this guide.

Section 8

Suggested Professional Reading

The following is a list of computer education journals and magazines that are recommended for professional reading:

The Computing Teacher, published nine times a year by the International Council for Computers in Education (ICCE) at a cost of $25.00 US from ICCE, University of Oregon, 1787 Agate St., Eugene, Oregon, 97403.

Electronic Learning, published eight times a year by Scholastic Publications at a cost of $23.95 CA from Scholastic Publishing, Magazine Department, 123 Newkirk Rd, Richmond Hill, Ontario, L4C 3G5.

Classroom Computer Learning, published eight times a year by Peter Li Inc at a cost of $22.50 US from Classroom Computer Learning, 2451 E. River Rd, Dayton, Ohio, 45439.

Computers in Education, published ten times a year by Moorshead Publications at a cost of $25.00 CA from Moorshead Publications Ltd., 1300 Don Mills Rd., Don Mills, Toronto, Ontario, M3B 3M8.

Several teachers resource books, available through the NS School Book Bureau, provide further insights for teachers with respect to the suggestions contained in these guidelines, including:

Learning with Logo (Apple Logo, Commodore Logo), McGraw-Hill, 1983.

The Art of Teaching Writing, Irwin Publishing, 1986.

Resource Listings

The following are available on request from The Microcomputer Resource Centre, Education Media Services, 6955 Bayers Road, Halifax, NS, B3L 4S4:

Educational Software Evaluation Report, a current report of software being evaluated by the Nova Scotia Department of Education.

Video Programs for Public School Use, and Catalogue of the Media Library, a catalogue of video productions and films for use in education.

Tutorials and Workshop Materials

A variety of locally developed tutorials are available. These will vary from time to time. When requesting those marked (disk), send in a blank disk. Currently available:

Appleworks Tutorials (disk)
Bank Street Writer Intro (disk), Commodore or Apple
Ideas to Accompany Bank Street Writer